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FOREST PEST MANAGEMENT

JACK PINE STEM RUST SURVEY HIAWATHA NATIONAL FOREST JUNE, 1984

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Galls of pine-pine rust

Cross-section of sweetfern rust

ABSTRACT

Jack pine (Pinus banksiana) stands on the Hiawatha National Forest in the eastern Upper Peninsula of Michigan were surveyed to determine the distribution, incidence, and impact of stem rust diseases. Pine-pine and pine-oak gall rust and sweetfern rust were observed on the Forest, but caused little overall impact.

INTRODUCTION

Jack pine (Pinus banksiana Lamb.) is one of the major sources of pulpwood in the Lake States and is also used for poles and lumber. Stem rusts are a group of diseases that cause reduced growth, degrade, and death of jack pine.

The five stem rusts that attack jack pine are:

Pine-oak (eastern) gall rust	Cronartium quercuum (Berk.) Miyabe ex Shirai f.sp. banksianae
Pine-pine (western) gall rust	Endocronartium harknessii (J. P. Moore) Y. Hiratsuka
Sweetfern rust	Cronartium comptoniae Arth.
Comandra rust	Cronartium comandrae Pk.
Stalactiform (cowwheat) rust	Cronartium coleosporioides (Diet & Holw.) Arth.

Although reports on the distribution and impact of some individual rusts in the Lake States are available (Anderson 1965; Anderson and French 1964; Anderson et al. 1967; Guilkey et al. 1958; Hart et al. 1978; McGrath and Patton 1969; Mital 1982), there has been no comprehensive survey for all five stem rusts of jack pine in the Lake States National Forests. The Chequamegon National Forest was surveyed in 1982 (Robbins 1983). This report summarizes a similar survey conducted on the Hiawatha National Forest in June 1984.

OBJECTIVE

The objective of this survey was to determine the distribution, incidence, and impact of jack pine stem rusts on the Hiawatha National Forest.

MATERIALS AND METHODS

The Forest Supervisor's Office provided a computer print-out of all jack pine stands on the Hiawatha. Stands representing the range of age classes present on the Forest were selected from the print-out.

A total of 33 stands were surveyed; 7 each on the Manistique, Munising, and Rapid River Districts, 8 on the Sault Ste. Marie District, and 4 stands on the St. Ignace District. The 33 stands sampled represent approximately 1.3 percent of the 2520 jack pine stands on the Hiawatha.

For each stand, the site index, acreage, age, origin (planted or seeded), density (jack pine stems per acre) and basal area of jack pine (ft^2 per acre) were recorded. Presence of alternate hosts and whether they were infected with rust fungi was also recorded.

Three fixed radius 0.02 acre plots were arbitrarily located in each stand. For every jack pine in each plot, its condition (alive, dying, dead), DBH, and number of 8 foot sticks (to a 4 inch diameter top) were recorded. Type of rust infection, based on descriptions by Robbins et al. (1981), was recorded. Cull due to stem rusts was calculated using the number of 8-foot sticks that were unmerchantable due to rust infections. The presence of other pests of jack pine was also recorded.

If present, aeciospores were collected for later laboratory examination to distinguish between pine-pine and pine-oak rust (Anderson and French 1965) and to confirm the presence of comandra rust (Robbins et al. 1981).

RESULTS

Distribution

Gall rust was found on all 5 Districts (Table 1). Most of the stands from which galls were collected proved to be pine-pine rust (Table 2). One stand (Rapid River, Compartment 34, Stand 10) had both pine-pine and pine-oak galls. Uredia of pine-oak rust were observed on the underside of oak leaves in 5 stands on the eastern half of the Forest.

Sweetfern rust was not found on any of the jack pine surveyed but was observed at two locations on the Forest: Manistique Ranger District: T 43 N, R 17 W, Sec. 23 (along the west side of Forest Road 2212) and Sault Ste. Marie Ranger District: Compartment 76, Stand 28. Neither comandra nor stalactiform rust were observed during the survey.

Incidence

Gall rust was found in 28 of the 33 stands surveyed and incidence by stand ranged from 0-87.5% (Table 1). Of the 1651 jack pine surveyed, 19.6% had gall rust. Galls located on the main stem ranged from 0-64% of the jack pine in the stands surveyed, but only averaged 8.3%.

To determine what factors influence the incidence of jack pine rusts, regression analyses were performed for six independent stand variables and the dependent variable of gall rust incidence (RSQUARE procedure, SAS Institute Inc., Cary, NC). The independent variables were stand age, basal area, density, site index, origin, and distance of the stand from the nearest Great Lake (Superior or Michigan). Incidence of gall rust showed no correlation with any of the independent variables.

Impact

Although gall rust was found to be a widely distributed and common disease on the Hiawatha, it caused little mortality or cull in the stands surveyed. None of the 1651 jack pine surveyed had broken or been girdled at a main stem gall. Of the 637 merchantable sticks of pulpwood evaluated in the survey plots only one half stick would have been culled because of stem rust. Little stem deformity could be attributed to the presence gall rusts.

Damage by several other pests was observed, but the amount of damage was generally not serious (see Appendix). The one exception was Scleroderris canker caused by Gremmeniella abietina (Lagerb.) Morelet that was killing many young jack and red pine on the Munising District.

DISCUSSION

The results of this survey confirm those from an earlier survey showing that pine-pine gall rust is more common in the Upper Peninsula of Michigan than pine-oak gall rust (Anderson 1965).

Incidence of both types of gall rust was considerably lower on the Hiawatha (19.6%) than on the Chequamegon National Forest (55%)(Robbins 1983). Impact was also lower, with little cull or mortality being associated with gall rust infections. Gross (1983) reported similar findings in an Ontario survey and also found essentially no growth loss caused by gall rust. He suggested, however, that mortality could be significant in young, understocked jack pine stands with high incidence of gall rust. A closer look at such stands might indicate what factors lead to the high level of stem deformity and mortality of jack pine that is sometimes seen in Canada and the Lake States.

RECOMMENDATIONS

Jack pine stands found to be severley damaged by gall rust during survival and stocking surveys should not be replanted with jack pine. Sporulating galls should be collected from these stands during late May to early June and sent to Forest Pest Management to determine if pine-pine, pine-oak, or both gall rusts are present. If information from these samples, subsequent surveys and research show that pine-oak gall rust is the major cause of damage, mixed stands of jack pine and oaks may have to be avoided by removing all oaks through cutting and by treating oak stumps with herbicides in stands scheduled to be regenerated to jack pine.

To alert nursery managers to the possibility of rust-infected planting stock, areas planted with jack pine should be checked one year after planting for swellings or galls on stems.

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Table 1.--Incidence of Gall Rust and Main Stem Galls in Jack Pine Stands on the Hiawatha National Forest, Michigan, June 1984.

District	Compartment	Stand	Age (yrs)	Trees With Gall Rust (%)	Trees With Main Stem Gall (%)
Rapid River	32	72	7	3.88	1.29
	34	10	55	13.04	8.70
	55	28	38	2.38	0
	56	8	5	10.53	2.63
	68	15	24	9.43	2.83
	78	25	44	3.12	0
	89	38	66	0	0
Manistique	11	12	59	0	0
	21	33	9	38.10	16.67
	38	18	7	35.14	0
	40	14	30	78.00	12.00
	44	31	25	60.61	15.15
	51	1	21	53.66	9.76
	69	1	16	65.85	26.83
Munising	51	6	9	2.56	0
	65	64	50	33.33	16.67
	66	7	21	64.00	4.00
	69	10	11	11.11	2.78
	85	43	30	3.22	0
	89	5	5	0	0
	92	25	58	27.78	5.56
Sault Ste. Marie	24	38	6	10.20	6.12
	23	7	51	80.00	33.33
	33	9	20	78.12	21.88
	47	47	37	57.58	0
	76	36	3	9.68	6.45
	55	25	13	80.00	64.00
	32	23	46	87.50	12.50
	30	36	3	5.00	2.50
St. Ignace	167	11	45	25.58	2.32
	170	48	42	0	0
	195	14	11	0	0
	167	25	45	15.09	0

Table 2.--Locations of Pine-Pine and Pine-Oak Rust on the Hiawatha National Forest, Michigan, June, 1984.

District	Compartment	Stand	Aeciospore Germination		Oak Leaf Uredia
			Pine-Pine	Pine-Oak	Pine-Oak
Rapid River	32	72	X		
	34	10	X	X	
	56	8	X		
	68	15	X		
Manistique	21	33	X		
	38	18	X		
	38	40*		X	
	44	31	X		
	51	1	X		
	69	1	X		
Sault Ste. Marie	23	7			X
	32	23	X		
	33	9	X		
	47	47			X
	48	24*	X		
	76	28*		X	X
	76	39*			X
St. Ignace	167	11			X

* Not surveyed for incidence or damage.

APPENDIX

Minor Pests of Jack Pine on the Hiawatha National Forest

Diseases:	Scientific Name
tar spot needlecast	Davisomycella ampla (Dav.) Dark.
pine needle rust	Coleosporium asterum (Diet.) Syd.
Insects:	
pine webworm	Tetralopha robustella Zell.
Zimmerman pine moth	Dioryctria zimmermani (Grote)
white pine weevil	Pissoides strobi (Peck)
pine spittlebug	Aphrophora parallela (Say)
northern pitch twig moth	Petrova albicapitana (Busck)
pine tortoise scale	Toumeyella numismaticum (P. & McD.)
aphids	